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Abstract

Background

Acute stroke is one of the leading causes of death in Israel and the primary cause of disability. In developed countries, there is evidence suggesting that the incidence rate of acute strokes has levelled off and is even on a downward trend. Nevertheless, according to projected changes in population size and composition, the number of acute stroke events in the developed world is expected to increase.

The objective of this study was to provide a forecast of the expected number of acute stroke events in Israel in the coming decades. Such a forecast is an important aspect of the knowledge infrastructure. It is also a tool to help policymakers make judicious decisions in planning and improving preventive, diagnostic and care services, as well as evaluate the future burden of care of acute stroke, and address the associated organizational and economic implications.

Methods

Since January 2014, the National Stroke Registry at the Israel Center for Disease Control has collected reports of acute stroke events affecting adult patients admitted to all the general hospitals in Israel. The incidence of acute stroke is calculated from the data of the registry, and of the Israeli Central Bureau of Statistics on population size. We generated forecasts for the number of acute stroke events on the basis of the mean incidence rate for 2014-16, by gender, age, and ethnicity, and of the projected population figures for these subgroups for 2015-65. The forecasts were generated for various assumptions as to trends in the subgroup-specific annual incidence rate, applied to each of the three growth scenarios for population size.

Results

Based on the intermediate population growth scenario, the annual number of acute stroke events is expected to increase from 18,000 to 65,000, 53,000 or 30,500 events, assuming constant annual incidence rates, decreasing annual incidence rates at a rate of 2% every 5 years, or decreasing annual incidence rates at a rate of 7.25% every 5 years, respectively. The forecasted increase in the number of acute stroke events derives from demographic changes in population size and composition, especially from a significant absolute and proportional increase of the 65+ population and an absolute increase

of Israel's Arab population, for whom the incidence rate of acute stroke is significantly higher than for the rest of the population. Whereas, presently, events affecting Arab patients account for 15% of acute stroke events and events affecting patients over 85 account for less than 20%, by 2065 Arab patients will account for more than 25% of the events, and patients over 85 will account for more than 30% of the events.

Conclusions

In view of the expected increase in the number of acute stroke events and the changes in the demographic composition of adults suffering from acute stroke, and in order to allow for optimal care and equity, it is imperative to evaluate the preparedness of care provision and the geographical deployment of treatment services in the short and long term.

Executive Summary

Introduction

Acute stroke is one of the leading causes of death in Israel and the primary cause of disability. It is associated with an increased economic burden consisting of acute-care costs in hospitalization, intermediate and long-term care, and rehabilitation costs in the community. Although there is some evidence indicating that the incidence rate of stroke has been decreasing in the past decades, the number of acute stroke events in the developed world is expected to increase in the coming decades due to demographic changes.

The annual incidence rate of acute stroke in the adult population in Israel in 2014-16 was 3.3 cases per 1,000 people or approximately 18,000 cases per year. The incidence rate varies across gender, age and ethnicity: it is higher among men, increases with age and, in Israel, higher among Arabs than among Jews and others. It is unknown whether the difference in the incidence rate across ethnicities emanates from a difference in the prevalence of risk factors, a genetic predisposition, or a combination of both.

The objective of this study was to provide a forecast of the expected number of acute stroke events in Israel in the coming decades. Such a forecast is a tool to help policymakers make judicious decisions about the volume of service provision, quantifying the need for additional care professionals and infrastructure, evaluate the future burden of care of acute stroke, and address the associated organizational and economic implications.

Materials and Methods

The National Stroke Registry (NSR) at the Israel Center for Disease Control receives reports of acute stroke events in patients admitted to all the general hospitals in Israel, including transient ischemic events, ischemic strokes, and intracranial hemorrhage events. The registry includes both demographic and clinical data on the patient, and data on the event and the treatment provided during hospitalization. We obtained data on all acute stroke events reported in 2014-16.

Every five years, the Israeli Central Bureau of Statistics (CBS) publishes long-term population forecasts by gender, age and ethnicity. Based on different assumptions on fertility, immigration and life expectancy, the CBS generates three alternative population forecasts (high, intermediate and low). We used these three CBS population forecasts for 2015-65.

In each subgroup, defined by gender, age and ethnicity, the expected number of acute stroke events for each year is the product of the subgroup-specific annual incidence rate and the subgroup's forecasted population size. The forecasts were generated with reference to three different assumptions on the rate of change of the annual incidence rates, applied uniformly across population subgroups: constant annual incidence rates, a decrease of 2% every five years, and a decrease of 7.25% every five years.

The CBS population forecast relies on specific assumptions about future mortality rates, projected from long-term past data. It is reasonable to hypothesize that the projected increase in life expectancy is associated also with changes in the prevalence of risk factors for cardio-vascular disease, in general, and for stroke events, in particular. Hence, conforming with evidence in the literature for steady, or even decreasing, acute stroke incidence rates in the past decades, the forecast, based on the assumption of constant annual incidence rates, should be considered as an upper bound for the future number of acute stroke events.

A second scenario was developed based on the findings of an important study from England (Oxford Vascular Study) that reported annual incidence rates of a first acute stroke in a homogeneous population, for two time periods, 20 years apart. Its findings formed the basis for the scenario assuming decreasing annual incidence rates at the rate of 7.25% every 5 years. The likelihood that the incidence rate of acute stroke will continue to decrease at this rate in the future is low. Thus, the forecast under this assumption should be considered as a lower bound for the future number of acute stroke events.

A third, mid-way scenario, assumes decreasing annual incidence rates at the rate of 2% every 5 years. The two latter assumptions about the expected trend of incidence rates of acute stroke were also employed in a similar work from Sweden.

The study was a collaboration with the department of general medicine at the Ministry of Health (MOH) and the NSR, and it was conducted under the auspices of the National Plan for the Treatment and Prevention of Stroke Damage. It was exempt from approval by the MOH Institutional Review Board.

Results

Based on the CBS intermediate growth scenario for the population forecast, and assuming constant incidence rates across all population subgroups, by 2065 the annual number of acute stroke events in the adult population is expected to increase 3.5 fold, from 18,000 to 65,000 events per year. The associated

forecast of the annual incidence rate for 2065 is 4.8 per 1,000. On the assumption of decreasing incidence rates, by 2065 the number of acute stroke events is expected to increase to 53,000 assuming a 2% decrease every 5 years (an annual incidence rate of 3.9 per 1,000), and to 30,500 assuming a 7.25% decrease every 5 years (an annual incidence rate of 2.3 per 1,000).

By 2065 the Jewish population (and others) is expected to increase 2.3-fold and the annual number of acute stroke events is expected to increase 3.1-fold, assuming constant incidence rates; or 2.5-fold and 1.4-fold, assuming decreasing incidence rates at a constant rate of 2% every 5 years, and 7.25% every 5 years, respectively.

Whereas the Arab population size is expected to increase 2.7 fold, the number of acute stroke events is expected to increase 6.2-fold in this ethnic group, assuming constant incidence rates; or 5.1-fold and 2.9-fold, assuming decreasing incidence rates at a constant rate of 2% every 5 years, and 7.25% every 5 years, respectively.

Accordingly, whereas presently, events in Arab patients account for 15% of acute stroke events affecting patients admitted to hospitals, by 2065 Arab patients will account for more than 25% of the events.

The greatest proportional increase in the annual number of acute stroke events is expected within the older age groups: the population size for the age groups of 65-74, 75-84, 85-94 and 95+ is expected to increase 2.5-, 3.5-, 5.4- and 11.3-fold, respectively. The annual number of acute stroke events within these subgroups is expected to increase 2.8-, 3.8-, 5.4- and 11.2-fold, respectively, assuming constant incidence rates; 2.3-, 3.1-, 4.4- and 9.2-fold, respectively, assuming decreasing incidence rates at a constant rate of 2% every 5 years; and, 1.3-, 1.8-, 2.6- and 5.3-fold, respectively, assuming decreasing incidence rates at a constant rate of 7.25% every 5 years.

Accordingly, whereas presently, patients over 85 account for less than 20% of the events, by 2065 patients over 85 will account for more than 30%.

Discussion

The number of acute stroke events in Israel is expected to increase substantially in the coming decades. The expected increase is attributed to demographic changes in the size and composition of the adult population and, in particular, to a substantial, absolute and proportional growth of the 65+ population, and an absolute growth of the Arab-Israeli population.

The expected increase in the number of events, and the changes in the age distribution of adults with acute stroke events have implications for the provision of both acute and long-term care: the prevalence of comorbidities is higher among older adults and acute thrombolytic treatments for ischemic stroke in these patients, pharmacological or endovascular, is associated with a higher risk of complications. The prognosis for older adults after an acute stroke event is worse, requiring complex, prolonged rehabilitation and long-term care; therefore, a greater proportion of acute stroke patients will require long-term care services. It is thus important to assess the availability and quality of long-term care of acute stroke patients, including nursing-home care and rehabilitation services.

Because of the high incidence rate in the Arab population, compared with the Jewish population and others, the expected absolute growth of the Arab population contributes significantly to the expected increase in the number of acute stroke events. Regardless of whether the higher incidence rate among Arabs emanates from a higher prevalence of risk factors, a genetic predisposition or a combination of both, it is important to ensure that the Arab population have access to high-quality care services, increase awareness and knowledge of acute strokes, and employ prevention strategies.

Alongside these changes, the economic burden associated with acute stroke is expected to increase due to increases in the volume of both acute hospital care and community-based intermediate and long-term care. Thus, it is of great importance to plan and implement effective programs for the prevention of acute stroke events.

Conclusions

The number of acute stroke events in Israel is expected to increase substantially in the coming decades. To ensure both high-quality care and equity for patients with acute stroke, it is imperative to evaluate the preparedness of short- and long-term services for acute stroke care and its geographical deployment. It is also of great importance to plan and implement effective programs for the prevention of acute stroke events.